XCVII. *A Diſſertation on the* Belemnites, *in a Letter to* Smart Lethieullier, *Eſquire, F. R. S. by Mr.* Guſtavus Brander, *F. R. S.*

SIR,

Read Nov. 21. 1754.

IT is owing to the pleaſure of ſome late converſations with you, upon the ſubject of natural hiſtory in general (in which I am always ſure to profit), that I now take the liberty to offer you my ſentiments concerning the belemnites.

The belemnites is a foſſil, that has hitherto perplex'd the naturaliſts of all countries: it has been treated of by various authors, and in turn been aſcribed to all the three kingdoms of nature; but, apprehending the road to truth ſtill open, I am encouraged to reſume the ſubject once more, and beg leave to deliver it as my opinion, that it belongs to the teſtaceous part of the animal kingdom, and to the family of the nautili. The nautilus, or ſailor, is a concamerated ſhell, with a ſyphunculus running through every cell, ſee *Tab.* XXXIV. *Fig.* 1. The ſyphunculus, and the concamerations, are the generical character of this tribe, and are ſuppoſed to ſerve the animal to buoy up its ſhell, by which means it can ſwim or ſink at pleaſure.

Thoſe that are curv'd are very common both in the recent and foſſil ſtate: the ſtrait ones have hitherto only been met with foſſil, and are common enough in Sweden, Livonia, and ſeveral parts of Germany; and have, by naturaliſts, been called orthoceratitæ;

thoceratitæ; nay, I have ſeen ſome in Dr. Maſon's private collection at Cambridge, which he told me were found in England, and, I think, came from Whitby; the character of which being exactly the ſame with the nautili, I make no ſcruple to claſs them together.

Whoſoever will examine nicely bodies of any genera, will have a difficulty to ſay, where they begin, and where they end; the gradation is ſo inſenſible, that they muſt be bewilder'd.

From the orthoceratitæ, which is undoubtedly a ſpecies of nautilus, we gradually proceed to the belemnites. The orthoceratites is a ſtrait concamerated ſhell, ending in a point; ſome of which I have ſeen in ſtone eighteen inches long; ſee *Fig*. 2, 3, 4, 5, and 12.

The nucleus, or alveolus, of the belemnites is likewiſe a ſtrait concamerated ſhell or body, exactly reſembling the other in ſhape and ſtructure, but of a ſmaller ſpecies, *Fig*. 6 and 10; and, I think, from the very great analogy, may reaſonably be deemed to be of the ſame family.

In the conic cavity of the belemnites, *Fig*. 7. that contains the nucleus, it is very common to obſerve viſible marks of a ſhelly ſubſtance, as a farther confirmation that the nucleus was a teſtaceous body.

And now a word as to the belemnites itſelf, the counter-part to the other.

It has indeed been truly matter of ſpeculation, how that huge ſolid ſubſtance called the belemnites, excluſive of the nucleus, could be formed; and how it happens that ſome ſhould have the nucleus within them, others not; the cavity to contain the ſame in ſome

ſome very ſmall, in others ſcarce or not at all viſible.

Theſe, I think, are the main difficulties, all which I ſhall endeavour to elucidate; but muſt firſt acknowlege myſelf obliged to Monſieur de Peyſonnel, and particularly to my worthy and ingenious friend Mr. John Ellis, F. R. S. for their curious obſervations on the nature of coral, upon which this latter part of my hypotheſis is founded. They have, I think, plainly demonſtrated, that many bodies which we always took to be vegetable from their appearance, are really animal, and conſtructed by the polyp; and that ſeveral coralline ſubſtances, hitherto reputed marine plants, are thick beſet with a prodigious quantity of ſeedling-ſhells (too ſmall for the naked eye to ſee), cloſe by each other, as diamonds in a bodkin, ready to come forth in due time out of their ſeveral neſts or cellules; ſee Philoſophical Tranſactions, Vol. 47. pag. 445. and Vol. 48. Tab. V. pag. 115. Whereupon I very humbly ſubmit, if it is not highly probable that the teſtaceous tribe in general are generated like butterflies, and flies of all kinds, the one from a maggot, the other from a polyp? Nay, it appears preſumptive to me, that it muſt be ſo with a great many. On which circumſtances I proceed, that as corals in general, from late obſervation, ſeem to be conſtructed by polypi, what inconſiſtency then to believe them to be the primary ſtate of all or moſt of the teſtaceous tribe? If ſo, it is almoſt beyond a conjecture, that the body called a belemnites (which, on being put into acids, is found to ferment in like manner as coral, and other cretaceous

ceous bodies), is formed likewiſe by a polyp, from which the nucleus ſeems to be the ultimate ſtate.

And I further ſubmit, whether this concamerated ſhell, or body, of which the belemnites is only the habitation, does not appear a ſtrong voucher for this new hypotheſis, by more immediately leading us into the connexion and manner of generation (perhaps particular to the teſtaceous tribe) by remaining within its nidus all its life; whereas the generality quit them ſo ſoon as they are able to ſhift for themſelves.

The polyp is an animal of the vermicular kind; the bodies of ſome are long and ſlender, like a fine ſinew or fibre, extremely tender; and from the head proceeds a variety of claws, or arms, with which it catches its food, and prepares its habitation, or chryſalis. They are without doubt of various ſhapes and textures, according (as I ſuppoſe) to the ſpecies of the animal that is hereafter to proceed from them *; and very wonderful it is, how ſo ſmall, ſo delicate an animal, ſhould be capable of forming ſo large a body as the belemnites! but is not every particular performance of nature equally the ſame to a diligent inquirer? ſo that I conceive the leſs cauſe againſt this opinion; more eſpecially as late authors have pretty clearly demonſtrated, that corals of much greater magnitude are conſtructed by them. Some animals in the terreſtrial part of the creation, naturally aſſociate and herd together. Others again ſeek ſolitude. The ſame diſpoſitions we find impreſſed on thoſe of the aquatic ſyſtem: then why not among the polypi? as is evidently ſeen from the prodigious variety of coral bodies, where it ſeems in ſome as if thouſands acted in concert together; in others, where each acts for itſelf; of which latter is the belemnites.

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* Mr. Henry Baker, F. R. S. has very ingeniouſly delineated a great variety of ſpecies of them, in his treatiſes on the polyp, and upon the microſcope obſerved in freſh water.

The ſhape of the belemnites is generally more or leſs conic, terminating in a point, and of various colours, according to the juices of the ſtratum in which it lay: it has uſually a ſeam or fiſſure, running down the whole length of it, ſometimes filled with a cretaceous ſubſtance. In ſome it is in the middle or axis of the body; in others on one ſide. Its interior conſtitution ſeems compoſed of ſeveral conoid cortices, or cruſts, which, when broken tranſverſely, appear to proceed in ſtriæ or rays from the ſeam or centre; which ſeam I take to have been the habitation or cell of the animal in its polyp ſtate, and in which the body was affixed; or perhaps ſerving as a ſyphunculus, in which was a ligament that proceeded from the nucleus in its perfect ſtate.

The cruſts that it is compoſed of, I ſhould apprehend, denote certain periods in the age of the animal; as the annual rings in a piece of timber, its age: but what thoſe periods are, we are unacquainted with; ſee *Fig*. 7, 8, 9, and 11.

The animals of the teſtaceous tribe in general, as they increaſe in age, increaſe their ſhell in thickneſs, until they have lived their ſtated time, or attained to good old age; and that is done by adding a new cruſt or lamina to it, as ſeveral, if not all the tubuli, the oyſters, and the nautili, witneſs (but theſe obſervations are beſt made on foſſil bodies, when, by great length of time the immediate cauſe of their adheſion becomes weakened, and diſplays to view their texture); after which they grow inactive and dull, the effect of extreme old age, ſuffering other marine bodies, as worms, oyſters, *&c.* to penetrate and affix themſelves to their outer coat. The like appearances we frequently meet with on belemnitæ, when the animal within, I ſuppoſe, was either wax'd old, or dead; and is an additional proof that the body is of marine origin.

Every one, that has made this part of natural hiſtory his ſtudy, muſt have obſerved, that the minutiæ, or exceeding ſmall foſſil ſhells, very frequently occur, and in the greateſt abundance, eſpecially in fine loam or clay proper to preſerve them: which ſhews that it was ſpring or ſpawning-time when the deluge overwhelm'd the country they were natives of. And that diminiſhes one of the difficulties concerning the belemnites, why ſome have the cavity, others not, or but very ſmall: for may we not attribute theſe ſeveral appearances to the different ages of the animal; as in the ſpring or ſpawning-time, and ſome time after, a thouſand ſmall fiſh appear in the water to one grown to maturity, or ſeedlings on the ſhores of ſhell-fiſh, to one at full growth? and, from a parity of reaſoning, is there not great likelihood to believe that every bellemnites would have had a nucleus, if it had lived? and to ſuppoſe that deficiency to be cauſed by the deluge coming on, in the early part of the ſeaſon, in that ſpot whereof they are natives, before they had attained perfection?

Not that I doubt of there being the ſame variety of ſpecies among the belemnitæ as of any other tribe in the teſtaceous kingdom, we are convinced of that: but let us, for argument ſake, ſuppoſe, that many never would have had a nucleus, that ſtill does not hinder, but that the body itſelf might be formed by a polype, only of a different ſpecies from thoſe, that have the nucleus. And after all, if it ſhould yet be objected, that the animal, though ever ſo ſmall, would retain the exact ſhape of what it would be in future, let them have recourſe to the fine collection of ſhells of my good friend Mr. Arthur Pond, F. R. S. where they may trace many families of ſhells from their minute ſtate, and ſee the regular progreſſions of the animal, till it has attained full growth; by which it will appear, that the reſemblance is often very ſmall between their firſt and laſt ſtate.

The country of the belemnitæ is unknown to us; but there is great probability it is the ſame with that of the conchæ anomiæ in general, and ammonitæ; ſince they are uſually found together, and are well ſuppoſed to be the inhabitants of deep or unknown ſeas, beyond human reach.

And now, Sir, having had ſo frequent occaſion to mention the orthoceratitæ in the courſe of this ſubject, they being here rare and uncommon foſſils, I have given the figures of ſome few ſpecies of them, which perhaps may not be unacceptable, N° 2, 3, 4, 5, and 12.

If it ſhould be aſked, whether they proceed likewiſe from a belemnites? I anſwer, that I ſuppoſe them to proceed from a polype like the reſt, but whether their parent polype formed itſelf a belemnites-like chryſalis or habitation (being a ſtouter animal), is more than I can affirm, although very probable, as the terminating point in them is as ſharp and fine as the nucleus of the belemnites; and it is obſerved, that all the turbinated ſhells increaſe their circumvolutions from the point, or apex; but that is not the immediate buſineſs of the preſent purpoſe, as nature has many ways to compaſs her ends. My deſign will be anſwered, if it ſhall only be thought, that I have evinced the belemnites to be an animal production, formed by a polype, as other coralline bodies; and its nucleus to be a concamerated teſtaceous body, of the nautili genus, proceeding therefrom.

Such is my hypotheſis of this hitherto not ſufficiently explained body; which I candidly ſubmit to better judgments, to approve or reject, as reaſon ſhall appear. I am, with perfect regard,

SIR,

Your moſt obedient humble ſervant,

Guſtavus Brander.

London, Nov. 14, 1754.

Deſcription of the PLATE.

No. 1. A ſection of a common nautilus.
2, 3, 5, and 12. Sections of orthoceratitæ.
4. An orthoceratites intire.
6. A ſection of a belemnites, with the nucleus.
7. Ditto, without the nucleus.
8. An oblique ſection of a belemnites, to ſhew the inward ſtructure.
9. A belemnites without a cavity, only a ſmall perforation.
10. A nucleus of a belemnites.
11. A belemnites, with a very ſmall cavity.

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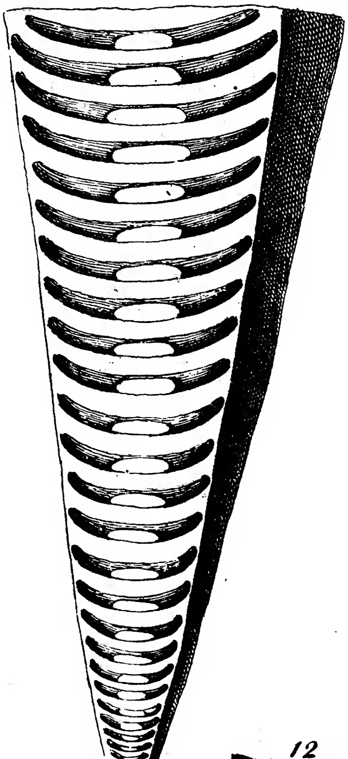

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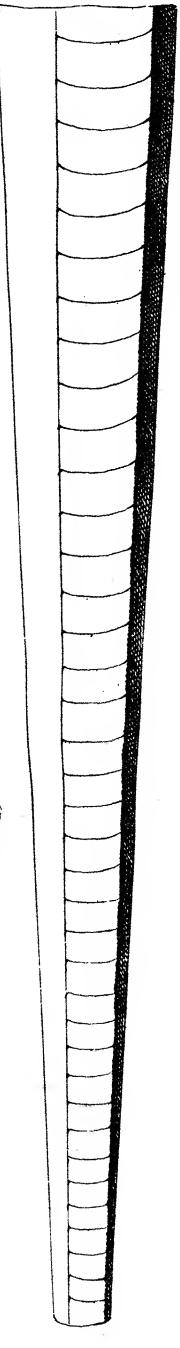

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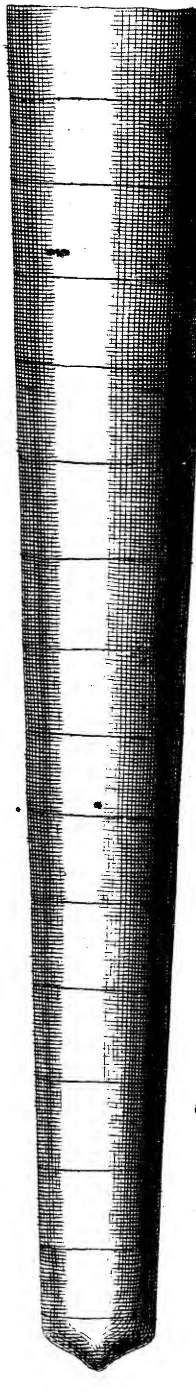

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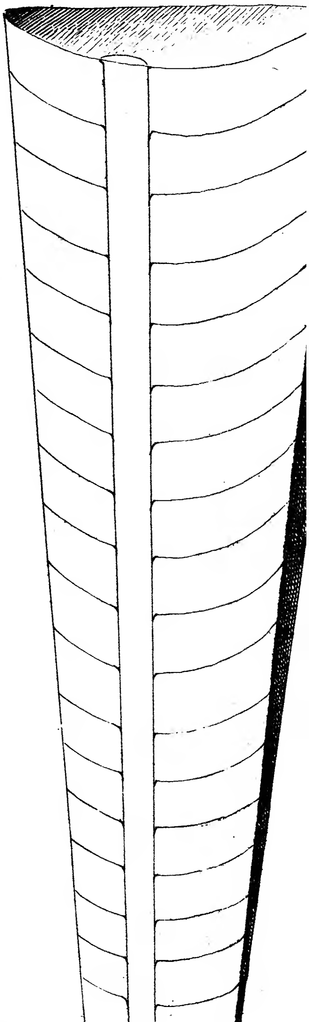

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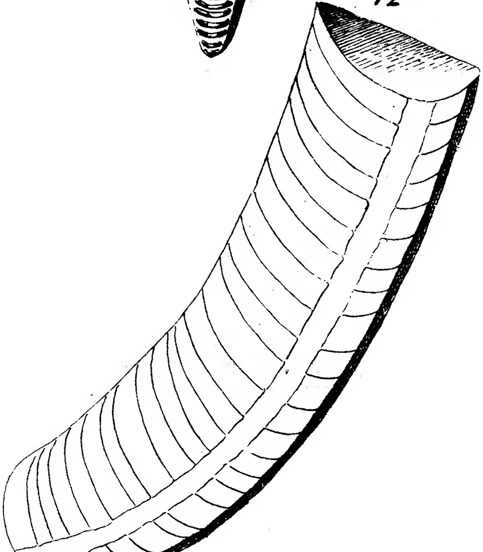

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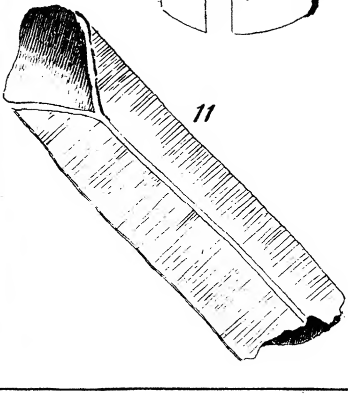

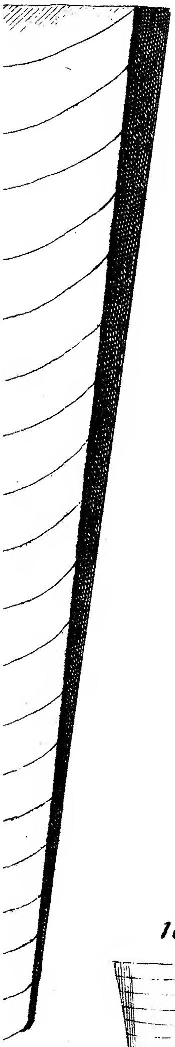

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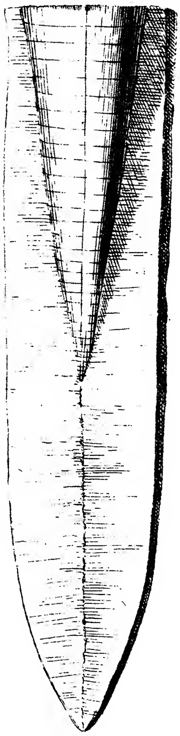

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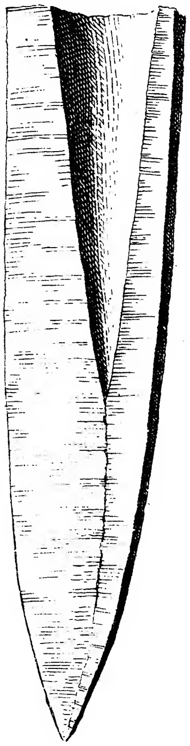

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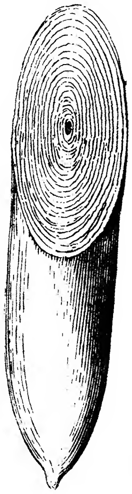

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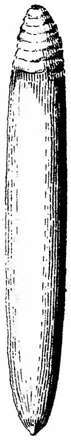

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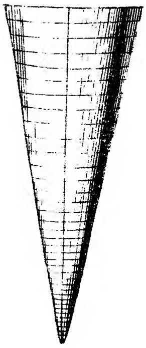

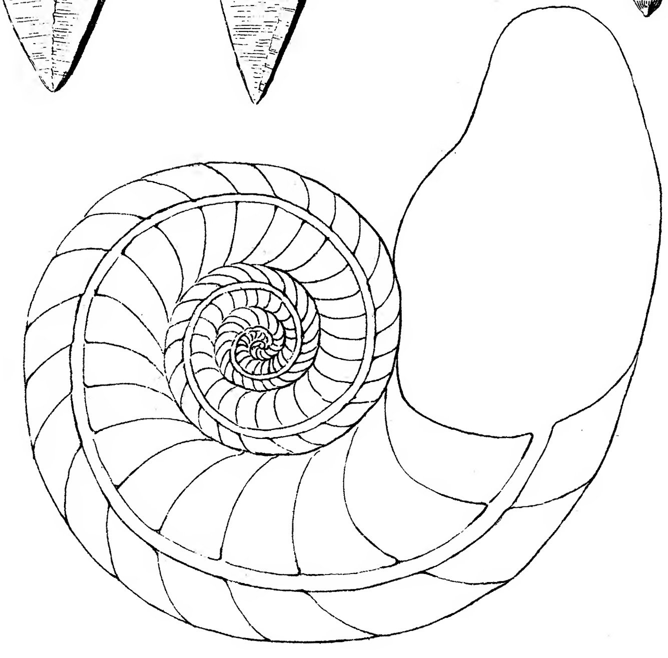

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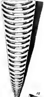

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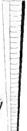

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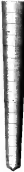

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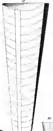

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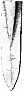

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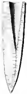

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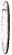

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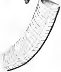

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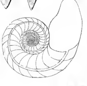

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